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Research Article

Role of Tranexamic Acid in Control of Blood Loss in Replacement Surgeries

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Abstract: A Prospective study of 140 patients was done in Sri Ramachandra medical centre from June 2011 to June 2013. The inclusion criteria were patients undergoing THR or TKR with Hb>10 and coagulation profile within normal limits. Out of 140 patients 50 underwent total hip replacements and 90 underwent total knee replacements. Patients were divided into two groups study and control groups. 1 gram of tranexamic acid ii 200 ml of saline is given 20 minutes before release of tourniquet in TKR or 20 minutes before skin incision in THR. Second dose and third dose were given at 3hrs and 6 hrs after the initial dose , irrespective of timing of surgery. Intra op blood loss was calculated by two methods, one was from haematocrit values and other was by observation of mops, drain and field loss. The average intra op blood loss in patients underwent total knee replacement in study group was 627.71 ml and in control group was 726.98 ml. The average intra op blood loss in patients underwent total hip replacement in study group was 596.48 ml and in control group was 871.64 ml. From our study it is evident that Tranexamic acid, given intravenously at the beginning of the operation, was an efficient and cost-effective way to reduce blood loss in total hip and knee replacement surgeries. Tranexamic acid also significantly reduces the need for allogeneic blood transfusions.
Keywords: Blood loss, Tranexamic acid, Antifibrinolytic, Total knee replacement, Total hip replacement, Transfusion

INTRODUCTION

Risks and costs of allogeneic blood transfusions mandate strategies to reduce blood loss in surgery. The objective of this study was to assess the efficacy of antifibrinolytic treatment in reducing perioperative blood loss during replacement surgeries. An increase in postoperative bleeding on removal of the pneumatic tourniquet had been described in total knee replacements (TKR) and was attributed to an activation of the fibrinolytic system in the first hours after surgery [1-3].The effect was positive in so far as it reduces the risk of thromboembolism in orthopaedic surgery but it can also increase postoperative bleeding which in turn frequently causes the need for blood transfusions. Medication that reduces hyperfibrinolysis could be administered to reduce blood loss [4] but the increased risk of thromboembolic complications must be taken into account.

The aim of the study was to find out the role of tranexamic acid in control of blood loss in total hip and total knee replacement surgeries.

MATERIALS AND METHODS

Prospective study of 140 patients done in Sri Ramachandra Medical Centre from June 2011 to June 2013.The inclusion criteria were patients undergoing THR or TKR with Hb>10 and coagulation profile within normal limits. The exclusion criteria were patients with bleeding disorders, thrombolic episodes and haematological disorders. We had 56 males and 84 female patients. Out of 140 patients 50 underwent total hip replacements and 90 underwent total knee replacements. Patients were divided into two groups, study and control groups. Among total knee replacement patients 47 were in study group and 43 were in control group. All the TKR were done under tourniquet. Patients were equally divided (25 patients) as study and control group in total hip replacement.

If the weight of patient was more than 60 kg, tranexamic acid of one gram in 200ml of saline was given over 10 to 15 min .It was given 20 minutes before release of tourniquet in TKR or 20 minutes before skin incision in THR. If weight of patient was less than 60 kgs half the above dose was given in same pattern. Second dose and third dose were given at 3hrs and 6 hrs after the initial dose, irrespective of timing of surgery. Second and third dose were given predominantly to control post op bleeding. Intra op blood loss was calculated by two methods, one was from haematocrit values and other was by observation

of mops, drain and field loss. Mean of those two was taken as intra op blood loss.

Calculation of intra op blood loss using haematocrit

Actual Blood Loss (ABL) = BV {Hi-Hf}/Hm

Hi: PCV Initial, Hf: PCV Final, Hm: PCV Mean, BV: Blood Volume-Body Wt x 70

Estimated Blood Loss (Ebl)

Swab Weight & Gauze Weight
Suction Bottle Volume
Field Loss

Post op blood loss calculated from collection from suction drain during first and second post op day. Blood transfusion both intra op and post op was noted. Each transfusion was prescribed with regard to the patient's cardiovascular history, present status, fall in Hb level, rate of blood loss and age. As a rule of thumb, we consider blood transfusion when Hb is below 8.5 g/l. We used no routine screening for thrombosis, but all clinically suspected thrombo embolic complications in the first six weeks were investigated further.

RESULTS

The average intra op blood loss in patients underwent total knee replacement in study group was 627.71 ml and in control group was 726.98 ml. The average intra op blood loss in patients underwent total hip replacement in study group was 596.48 ml and in control group was 871.64 ml. The average post op drain in THR patients in 1st post op day were 465 ml in control and 303 ml in study group. Similarly 2nd post op day drain was 93ml in control and 27ml in study group. The average post op drain in TKR patients in 1st post op day were 478 ml in control and 287 ml in study group. Similarly 2nd post op day drain was 87 ml in control and 34 ml in study group.

There was nearly 32% less blood loss in THR study group and 15% less blood loss in TKR study group compared to their control. Similarly there was nearly 41% and 44% less post op drain on 1st pod in THR and TKR study group respectively. The study group patients needed 20 transfusions while patients in control group had 60 blood transfusions.

Table 1: T-Test for Blood loss in THR

Group	N	Mean	Std. Dev	Std. Error Mean
Control	25	871.646	413.345	84.373
Study	25	596.498	147.053	29.410

Table 2: Mann-Whitney Test for Blood loss in THR

	Blood loss	POD 1
Mann-Whitney U	149.000	122.000
Wilcoxon W	474.000	447.000
Z	-3.031	-3.581
Asy.Sig(2-Tailed)	.002	.000

Table 3: T-Test for Blood loss in TKR

Group	N	Mean	Std. Dev	Std. Error Mean
Control	43	726.981	248.235	37.855
Study	47	627.717	255.278	37.236

Table-4: Mann-Whitney Test for Blood loss in TKR

	Blood loss	POD 1
Mann-Whitney U	757.000	964.500
Wilcoxon W	1885.000	1910.500
Z	-2.048	-.372
Asy.Sig(2-Tailed)	.041	.710

DISCUSSION

Tranexamic acid (TXA) [5-7], epsilon-aminocaproic acid (EACA) [8-10] and aprotinin were three antifibrinolytics agents that can be used to decrease perioperative bleeding in TKR [11] and other surgical procedures [12-16]. Some studies have shown that aprotinin may be slightly more efficacious than other antifibrinolytics but with poorer cost-effectiveness and with a potential risk of anaphylaxis [8, 9, 17, 18].

In a study of 55 patients undergoing total hip replacement, Harley and colleagues [19] found that

EACA greatly reduced postoperative bleeding and the need for transfusions but there were no studies on TKR. As the risks of allogeneic blood transfusion had been revealed, programmes of blood conservation in orthopaedic surgery had become more desirable. The most direct approach was the reduction of perioperative and postoperative blood loss. Various surgical and anaesthetic methods were used, but blood conservation can also be achieved by pharmacological means.

In our study, tranexamic acid, given intravenously at the beginning of the operation, was an efficient and cost-effective way to reduce blood loss in total hip and knee replacement surgeries. Tranexamic acid also significantly reduces the need for allogeneic blood transfusions. In our study of total hip arthroplasty intra op blood loss was 596 mL in the study group and 871 mL in the control group which was comparable to the study conducted by Benoni *et al*. [20] in 2001 which stated that the total blood loss was 759 mL in the study group and 996 mL in the placebo group. From tables 1, 2 it was clear that the blood loss was statistically significant when tranexamic acid was used.

In our study on total knee arthroplasty, total blood loss(intra and post op) was 897 ml in the group that received antifibrinolytic agents and 989ml in the control group ,which was comparable to study by M.A Camarasa *et al*. [21]. They had a total blood loss was 1099 ml in the group that received antifibrinolytic agents and 1784 ml in the control group. The total blood loss for both study and control patients, however, was less than in the two previous studies. This discrepancy may be due to differences in surgical and anaesthetic techniques in the previous studies, the administration of colloids, with their potential effect on blood loss, differed between study and control patients. This possible source of error was decreased in our prospective work. The tables 3,4 confirms the statistical importance of use of Tranexamic acid in total knee arthroplasties.

To measure accurate amount of blood loss, two methods of calculation of blood loss were followed and mean of those two was taken as intra op blood loss. It was observed that blood loss calculations by haematocrit values were more accurate than the observation technique because of the wide variation between observers. There was a major reduction in post op drain collection in the study group. It was clinically observed that post op drain in first 24 hrs in the study group was reduced nearly by 44% in TKR and 41% in THR.

Blood was a finite resource with a limited shelf life and was associated with considerable processing costs [22]. Utilization of this resource needs critical review to identify areas of overuse and thus reduce risk to patient and hospital costs. Risks of homologous transfusion vary in type and severity. Morbidity and mortality may result from either an immunologically mediated reaction or a transmitted infection. Perioperative transfusion triggers for RBCs include physiologic signs of inadequate oxygenation of the entire or of a specific organ, haemoglobin concentration and logistic aspects such as experience of anaesthesiologists and surgeons, predictability of blood loss and time required for a haemoglobin determination and RBC delivery [23].

Defining transfusion triggers for red blood cell transfusions was important to avoid unnecessary RBC transfusions and equally to avoid under transfusion in situations where RBC transfusions may be beneficial [23]. The American College of Physicians recommended that RBC transfusions should be done unit by unit and the patient should be evaluated between each transfusion. In their study of patients undergoing curative surgery Tartter and Barron [24] concluded that excessive intraoperative transfusion and the practice of administering blood without re-evaluating the haematocrit in between resulted in 90% of the unnecessary transfusions. They further recommended that the determination of the haematocrit immediately before administration of each unit would reduce blood consumption by 25% [25].

There was a considerable reduction of transfusions in post op period hence there was a reduced hospitalization cost and less risk of transmitted infections and transfusion reactions. From our study it was observed that intra op blood conservation using tranexamic acid was relatively better in total hip arthroplasties than in total knee arthroplasties. We did not routinely conduct screening for thrombosis in our study. One patient in our study group developed DVT. Previous research on tranexamic acid and thrombosis had failed to show any thrombogenic effect, even in patients who were treated for several days or even weeks [26,27,28,29]This may be due to the fact that fibrinolytic activity in vein walls was not affected by tranexamic acid[30,31] have shown that thrombosis prophylaxis using low-molecular-weight heparin delayed the onset of thromboses to the fourth or fifth postoperative day. For these reasons we consider it highly unlikely that we would had been able to show any thrombogenic effect of the administration of tranexamic acid. Complications were negligible when using Tranexamic acid.

CONCLUSION

Tranexamic acid was an effective tool in controlling blood loss and reducing blood transfusions in replacement surgeries. There was a definite reduction in intra op blood loss when tranexamic Acid is used in patients undergoing Replacement surgeries (TKR P =0.41,THR P=0.002) .Post op drain collection in study group was significantly less than that of control group. Reduced number of blood transfusions in the study group when compared to the control group. Complications were negligible when using Tranexamic

Acid. Blood loss calculation by haematocrit values was more accurate than that calculated by mops and drains due to poor inter observer errors.

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